all its members having the same parents, grandparents, uncles and aunts, and every other ascending or collateral relationship. It is not strictly so as regards descent, because the children of each brother or sister are nephews or nieces to all the others, but this material exception leads practically to no confusion. A fraternity is, therefore, treated as a compound unit, the individuals who form it being distinguished by their several names. Thus Rose Gore, 205, serves as a complete definition of her. The husbands and wives of the fraternity 205 belong severally to fraternities of their own, the numbers of which are attached to their names; thus the husband of Rose Gore, 205, is Stephen Bell, 270. Her father, Fred Gore, belongs to group 101, and her mother, Mary Drew, to group 144. Both of these latter groups are printed here. Each parental couple heads a new group; thus, Fred. Gore, 101, and Mary Drew, 144, combine to form the head of the new group 205. Similarly, Rose Gore, 205, and Stephen Bell, 270, form that of the new group 315. It must be clearly understood that there is no relation between these numbers as such; they indicate no more than the No. of the page on which the new group happens to be entered. Every individual who is married and has children is entered in at least three different family groups, (1) that of his own fraternity, (2) in that of his wife, (3) in that in which he appears as one of the parental couple. If he marries a second time and has children, his name will appear as a parent in a fourth group, thus Mary Drew, 144, is entered as mother in each of the two groups 328 and 340. It will be noticed that the day and month of birth is added to the name of each parent. This is a useful distinction in some Welsh and Scotch pedigrees where the same names repeatedly occur. It is a distinction of great efficacy, as the chance against a namesake having the same birthday is about 365 to 1. If so, the chance against a namesake *couple* having the same birthdays as the couple in question would be 365×365, or upwards of 130,000, to 1.

Employment of the Tables.—Let us follow out the relationships of Frank Gore, 205, as far as these three tables permit. His father, as we know, is Fred. Gore, 101. Referring to 101, we see that his paternal grandfather and grandmother are John Gore, 31, and Amy Myers, 43, respectively, so we should have to refer to the family groups 31 and 43, which are not given here, to know more about them and their own near relations. We see that Frank Gore, 205, has two paternal uncles, George and Stephen; George married Jane Boyle, 136, and has the children described in 211; Stephen is unmarried. Frank has also three paternal aunts, Ellen, Susan and Fanny; the second unmarried, Ellen married to John Piers, who has children in 237, and Fanny married to Harry Pitt, 163, who has children in 223. Jane Boyle's immediate relations are to be found in 136, those of John Piers in 237, and those of Harry Pitt in 163. The fraternities 211, 237 and 223 exhaust the list of Frank Gore's first cousins on the paternal side. The group 144 enables an equally complete analysis to be made on the maternal side. We can proceed in this way step by step as far as material exists. Intermarriages create no difficulty. The extreme confusion that arises from the ambiguous words of uncle, aunt, cousin, &c., is wholly eliminated by this method of working, also that which is due to half-blood relationships.

It should be remarked that information is usually to be obtained with ease concerning any particular family group, because a knowledge of its details is shared by many persons. The father and the mother each know, of course, the names of their own children, and of those to whom they are married, in all but very exceptional cases. Similarly each brother and sister knows the full Christian name of his father and mother, and the mother's maiden name also, as well as the names and order of birth of his or her own brothers and sisters. This same knowledge is usually shared by the brothers- and sisters-in-law.

This method of fraternal unities and of family groups may be applicable to experiments in breeding animals and plants, but with modification of detail appropriate to each case. Where the breeding season is brief, the birthday would be of small distinctive value, even when the year of birth is added to it. FRANCIS GALTON.

STANDARDISATION.[1]

THE first two publications referred to below are the first direct outcome of the work of the Engineering Standards Committee; the third is very intimately connected with that work.

The committee was appointed nearly two years ago, and owes its origin to the councils of the five great technical engineering societies acting on the suggestion of the council of the Institution of Mechanical Engineers.

Its existence is a symptom of the times, an indication of the fact that English engineers have grasped the importance of scientific cooperation and the necessity for organisation on a scientific basis.

The main committee consists of fourteen representatives of the five societies, leaders in the various engineering industries which they represent, and these have called to their assistance seven or eight sectional committees and a number of subcommittees to advise on special points. Representatives of the technical Government departments serve on many of these, and the movement has the support of the leading manufacturers. The work has grown and is growing; investigations of various kinds are needed to elucidate doubtful points before the committees can finally report; some of these are in progress at present at the National Physical Laboratory and elsewhere, and many men are working in a manner unknown before to strengthen English industry and to enable it to compete on favourable terms with foreign rivals.

Some months since it was announced that the committee dealing with steel structures was prepared to reduce considerably the number of sections to be rolled as a regular thing and stocked by the manufacturers, and the list it has proposed has just been issued. The committee is to be congratulated on its work. In all cases there has been great reduction and simplification, a result which will lessen the cost of production by reducing the number of rolls required, and will quicken the rate of supply by permitting stocks to be kept on hand. Thus it appeared that some forty-nine or fifty sizes of beams were in common use; these have been reduced to thirty; while for channels, in place of sixty-three, there are to be twenty-seven sizes rolled.

The recommendations as to rails have not yet been finally issued; at present there are seventy-three different sizes of tramway rails rolled; it is hoped to reduce these to five.

Messrs. Dorman Long and Co.'s new list referred to above is based on these standard sizes, of which a large supply is kept in stock at their various depots. The list gives, in addition to the dimensions and weight of the beams, various other data of importance, *e.g.* the moments of inertia about certain axes, and the safe distributed load for spans of various lengths.

[1] British Standard Sections issued by the Engineering Standards Committee.
British Standard Beams. (Dorman Long and Co.
Standard Sizes of Conductors. (Cable Makers' Association.

But these lists, valuable as they are, contain but a very small portion of the results we may hope for. The committees on sections used in ship building, on locomotives, and on electrical plant, each appeal to an enormous industry, and in each of these there is much that can be standardised. Take, for example, the various sizes and speeds used in dynamos and motors, the numerous voltages in electric light and power systems, and the varying frequencies of alternators. The committee on electrical plant, of which Sir Wm. Preece is chairman, has subcommittees on electric generators, motors, and transformers under Colonel Crompton, on telegraphs and telephones under Mr. Gavey, and on cables under Mr. R. K. Gray.

Both in America and in Germany committees on the standardisation of electric plant have reported within the last few years, and the value of their work is generally recognised; their results will be of distinct service to the English committee when the time comes to frame its report. Meanwhile one important industry has already acted. The lists of standard sizes issued by the Cable Makers' Association carry out in an admirable manner the principle of standardisation.

There is no doubt that the belief expressed by the association that the adoption of these standards will act equally for the benefit both of the purchaser and of the manufacturer is well founded, and it is greatly to be hoped that they may be adopted.

Standardisation, of course, has its dangers; it may tend to crystallise the form of products, and thus to delay progress. These possible dangers are clearly before the minds of the practical men who form these various committees, and will have due consideration in their reports. Meanwhile, we can only repeat that the need for standardisation is enormous, and its advantages immense.

The announcement contained in the papers recently that a vote of 3000*l.* for the work of the committee is to be included in the estimates for 1903–1904 is a gratifying recognition of the value of its work, and Sir Francis Hopwood expresses the view of all qualified to judge when in his letter intimating this grant he writes:—

"The Board of Trade desire me to state that they regard the work undertaken by the committee, including as it does the preparation of standard specifications for engineering works, and of standard sections of rolled iron and steel, together with the standardisation of parts of locomotives and electrical appliances, as tending to reduce both the cost of production and the time occupied in completion, and as being of the highest value to the country at large."

But, as has been already said, the work yet accomplished is but a small fraction of that which remains to be done, and the further reports of the committee will be eagerly expected by engineers.

ITALIAN VISIT OF THE INSTITUTION OF ELECTRICAL ENGINEERS.

THE Institution of Electrical Engineers has just completed a visit to northern Italy to inspect the chief works of engineering interest. The Institution has made several continental visits of this kind during the last few years, and although it is difficult to gather much in the way of detail on such occasions, it nevertheless seems to be helpful to many to get some general ideas of what our neighbours are doing, and at the same time to get the advantage of a little pleasure from the scenery which, in this case, is among the most beautiful to be found in Europe.

Probably the piece of work that was looked forward to with the greatest interest was the electric railway from Lecco to Sondrio and Chiavenna on the Ganz system, as it forms a bold experiment, and is the first of its kind. The total length is sixty-three miles. The electric energy is generated by three-phase machines at 20,000 volts, and is transformed down at nine points along the line to 3000 volts, this comparatively high voltage being taken direct by the trolley to the motors. Voltage as high as this necessitates many unusual precautions of an interesting kind; for example, the rheostats and switches are worked pneumatically, so that the driver does not operate direct any apparatus subject to high tension. The method of coupling up the motors is also interesting from its novelty. Instead of working the motors in the usual way, they are divided into high and low tension motors. The high pressure current is taken only to the stators of the high tension motors; the rotors of these machines are used to supply low tension three-phase current to the stators of the low tension motors. The low tension motors are thus supplied with current at a lower frequency than the main current. This "cascade" method of working is continued until half speed is attained, when the low tension motors are cut out and full speed is reached on the high tension motors alone.

The recent arbitration, in which it was decided not to use the Ganz system for the Metropolitan Railway, is still fresh in the minds of most people. Although this system does not seem so suitable for cases in which the acceleration at starting and the speed must be high, it should certainly afford a cheap method of working long lines not having much traffic. As seen at Valtellina, the ease and smoothness of working were all that could be desired.

On looking at the boldness of the experiment, one cannot help being struck by the difference between Italy and our own country in taking up a thing of this kind. But it must not be forgotten that one of our greatest sources of wealth tends to keep us from using electrical methods. If the price of coal were double its present value, which is the sort of price which holds in Italy, then the coal bill would be a larger proportion of the whole cost, and it would be more worth while to attempt a saving.

The usual form of electric traction by means of direct current at 650 volts, transformed from high tension three-phase, was seen on the line from Milan to Gallarate and Porto Ceresio. This line is forty-seven miles in length, and also differs from that to Valtellina in having much heavier traffic and higher speeds, and in being partly worked by steam. It is therefore of great interest to those who are at present considering the electrical working of our main lines.

Overhead lines are, of course, a feature of every long-distance transmission. It does not seem to be generally realised how much we have to pay for putting all conductors underground, though this subject will no doubt come forward more prominently when our large power distribution companies get really to work. One disadvantage of overhead lines is that they are subject to lightning discharges. Many protecting devices have been tried, and a particularly interesting one was seen at the Monbegno generating station on the Valtellina line. It consisted of jets of water forming a permanent earth, but of such a resistance that the loss does not amount to more than about 2 kilowatts. The action is said to be very satisfactory.

At Milan several large works were visited, and also the Royal Technical Institute. The latter is not very large, but is usefully equipped. The room for electrical measurements contains instruments in one group for measuring all the usual quantities over a wide range. In the motor and dynamo testing room the